Microsoft

Broadband mapping meeting with FCC Steve Rosenberg and Allison Baker

September 18, 2019

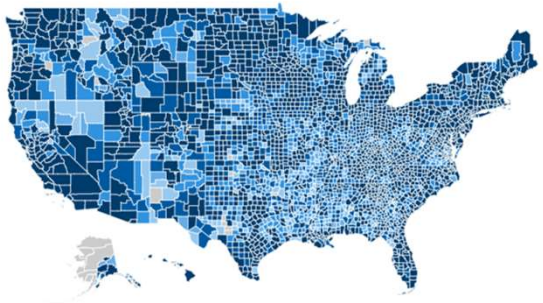
Areas of discussion

- Form 477 vs Digital Opportunity Data Collection order
- Regarding the digital opportunity data collection
  - How are you planning to use the shape files approach to calculate and report availability coverage vs the current census block approach?
  - Are you planning on leveraging both availability and usage data in your crowdsourcing solution?
  - What is the timing?
- Outlier zip code analysis on existing availability data

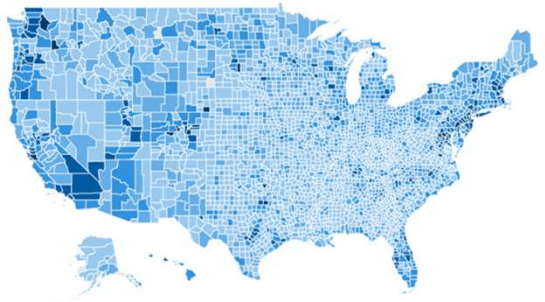
Broadband usage based on Microsoft data

- FCC reports 93.5% of the country has access to fixed broadband at a minimum of 25 Mbps/3Mbps; Microsoft estimates ~49% of people access the internet at broadband speeds
  - Availability does not equal usage; however usage gives us the ground truth in the progress we are making in broadband adoption.
  - Through artificial intelligence and machine learning models using device level (no PII) data (over 200+ Microsoft services) we estimate download speeds and broadband coverage
  - We make a very minor adjustment in areas of the country that Microsoft may not have a presence with third party data i.e. ComScore

FCC indicates broadband is available to 93.5% of people



Microsoft indicates 49.5% of people use the internet at broadband speeds



* FCC fixed broadband has or "could" provide greater than or equal to 25Mbps / 3Mbps

Broadband speed greater than or equal to 25Mbps

Data sources: FCC 2019 Broadband report based on Form 477 data from December 2017 and Microsoft data from September 2018

Objective of the analysis

- Hypothesis: If we can find zip codes with inaccuracies in availability data in an automated way using machine learning this could help the stakeholders to correct data inaccuracies.
- Utilizing further machine learning to predict availability, we have created a model to identify a subset of zip codes that MAY have inaccuracies.
- There is no guarantee that these zip codes are being reported inaccurately; however based on using a machine learning model and additional validation with a third-party survey done by BroadbandNow, these identify areas of potential inaccuracies.
- Our plan is to make the model publicly available on GitHub and the output publicly available in the near future.

Methodology

- Developed Machine Learning models (random forest for regression) to predict broadband availability in order to identify potential outlier zip codes when compared to the form 477 data submitted to the FCC.

- We take the FCC availability data at the census tract level and estimate to zip codes.

- Data sources:
  - FCC Form 477 (grouped by zip code)
  - Broadband usage based on Microsoft data
  - Census data by zip code
  - Broadbandnow.com data
  - HUD census tract to zip code crosswalk

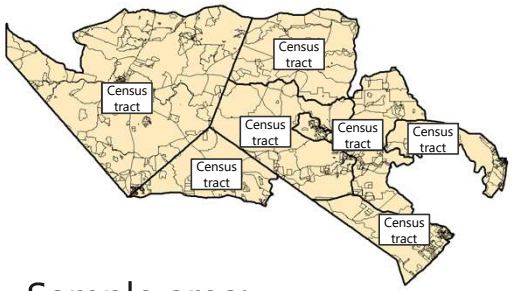
Zip code availability

- We take the FCC availability data at the census tract level and estimate to zip codes using the HUD crosswalk file

Census blocks
(~11M national)

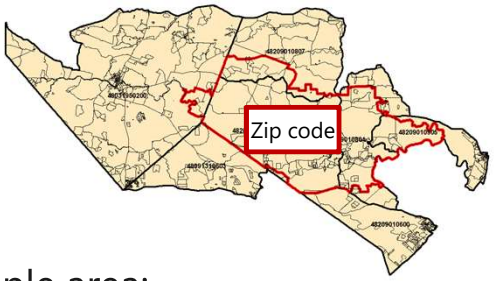
Sample area:
- 1,605 census blocks
- 83.1% broadband available

Census tracts
(~73K national)



Sample area:
- 1,605 census blocks rolls up to 7 census tracts

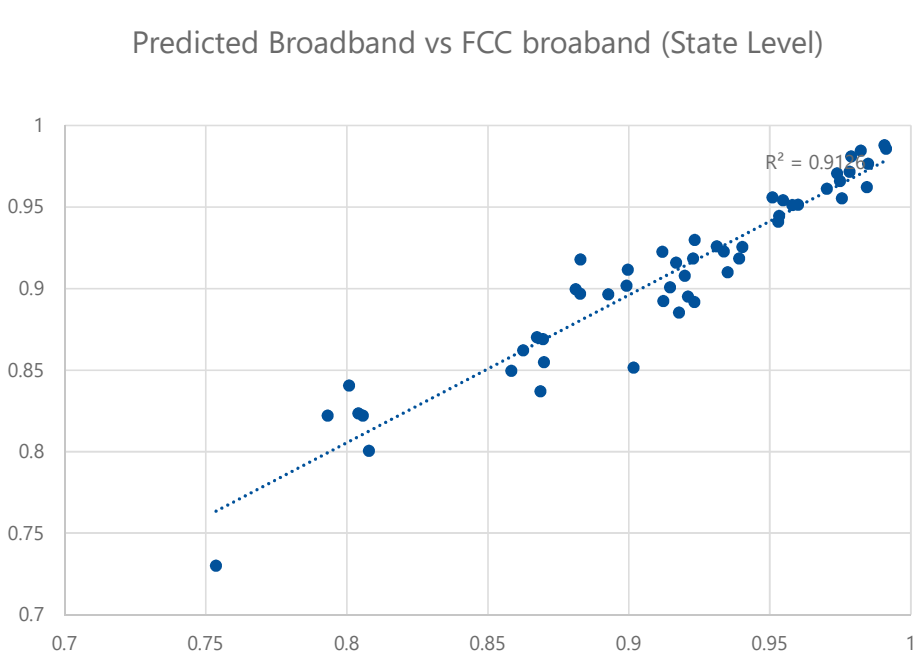
Zip codes
(~32K national)

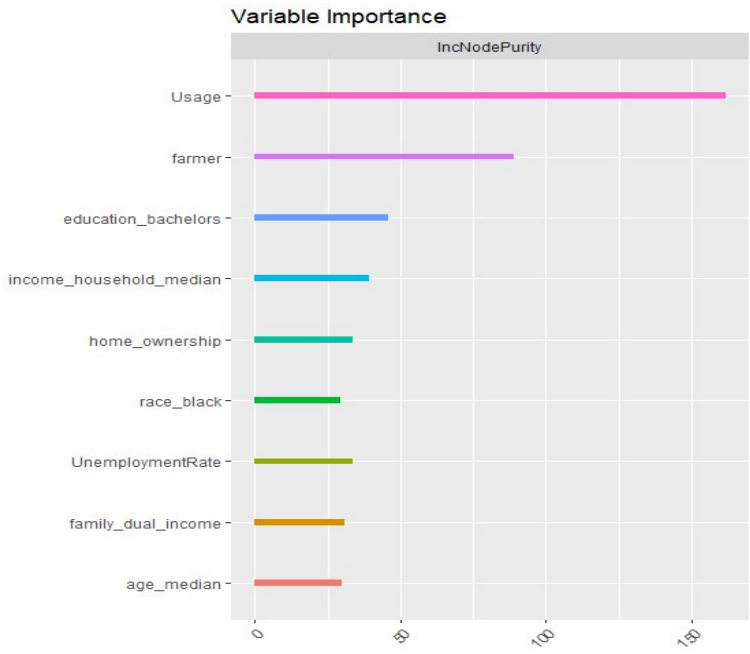


Sample area:
- 7 census tracts make up one zip code
- HUD crosswalk file used to determine percentage of each tract associated to a zip code

Predicting broadband availability

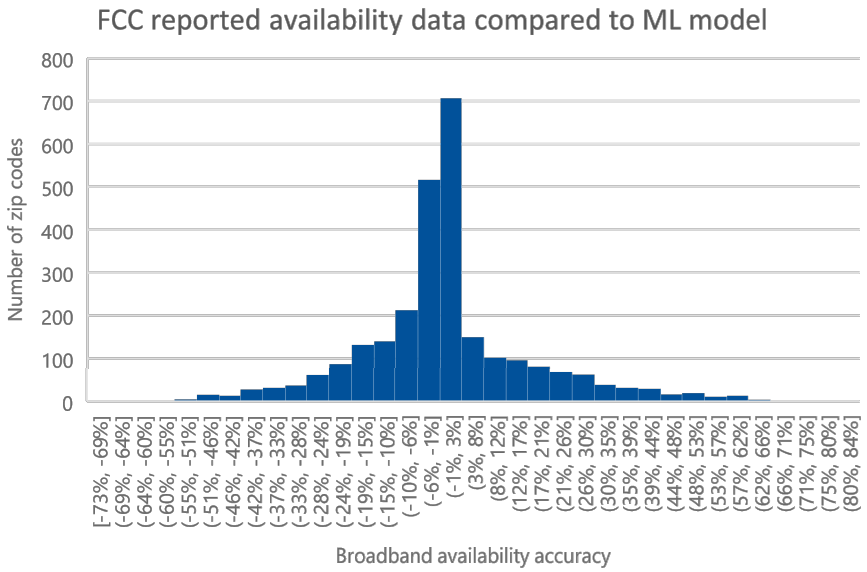
- We use a random forest model and measure variable importance.
- Broadband usage is the #1 variable with the highest predictive power followed by percent of farmer and educational attainment.
- At the state level this model can predict with an r^2 of 91%.

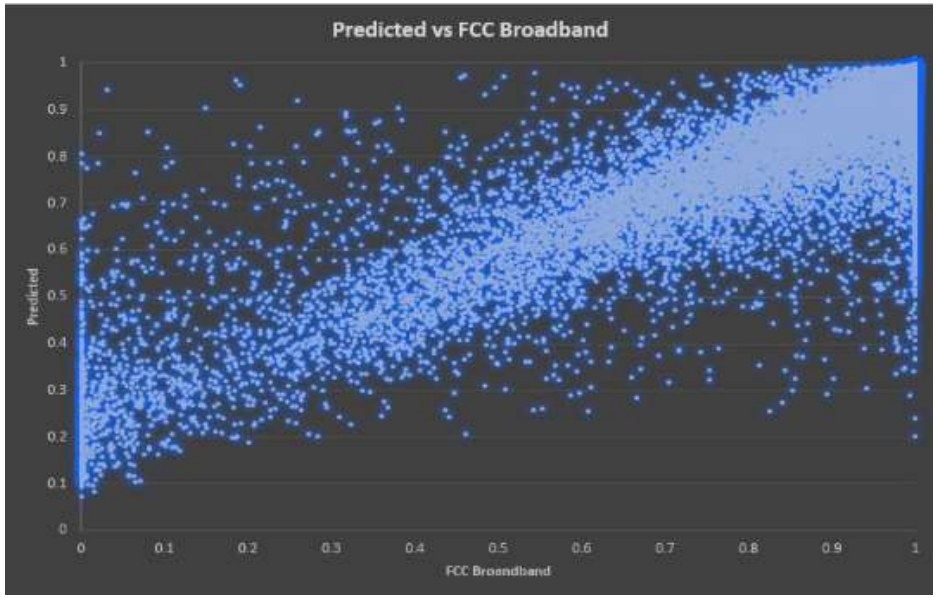




Ability to detect potential outliers

- We use this model to detect potential outliers with the highest divergence (positive and negative) to the reported broadband availability
  - ML model predicts 63% of zip codes within 5pts of reported broadband availability
  - ML model predicts 78% of zip codes within 10pts of reported broadband availability





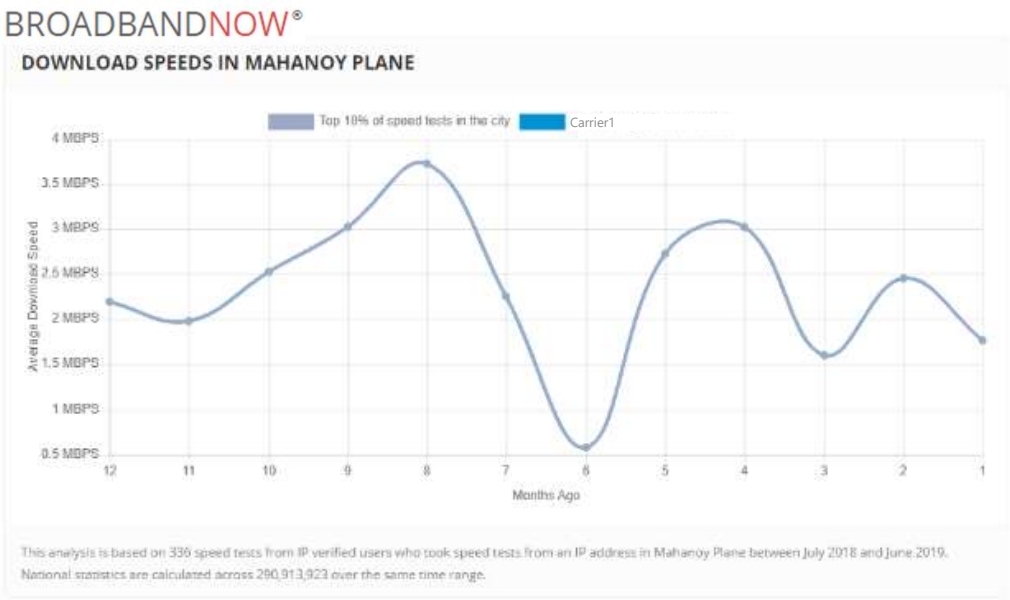
Top 20 potential outlier zip codes

State	Zip code	FCC broadband availability 2019 report	Usage Feb 2019
PA	17949	91.8%	0.0%
VA	22742	100.0%	0.5%
WV	26386	100.0%	9.5%
FL	33890	94.0%	4.7%
OH	44076	92.1%	5.9%
OH	45856	98.3%	4.5%
IA	50514	98.0%	4.5%
MN	56282	100.0%	3.7%
KS	66079	100.0%	0.6%
AR	71956	97.3%	6.1%
AR	71968	99.1%	7.7%
OK	74332	99.9%	0.7%
TX	78118	100.0%	3.4%
TX	78151	99.6%	0.5%
TX	78941	99.5%	2.8%
CA	93602	93.7%	8.5%
CA	95638	100.0%	2.2%
OR	97456	94.7%	7.6%
WA	98855	97.9%	7.4%
WA	99122	100.0%	4.0%

Zip code: 17949 in Pennsylvania

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
91.8%	0.0%

* *zip codes may contain portions of multiple census tracts*

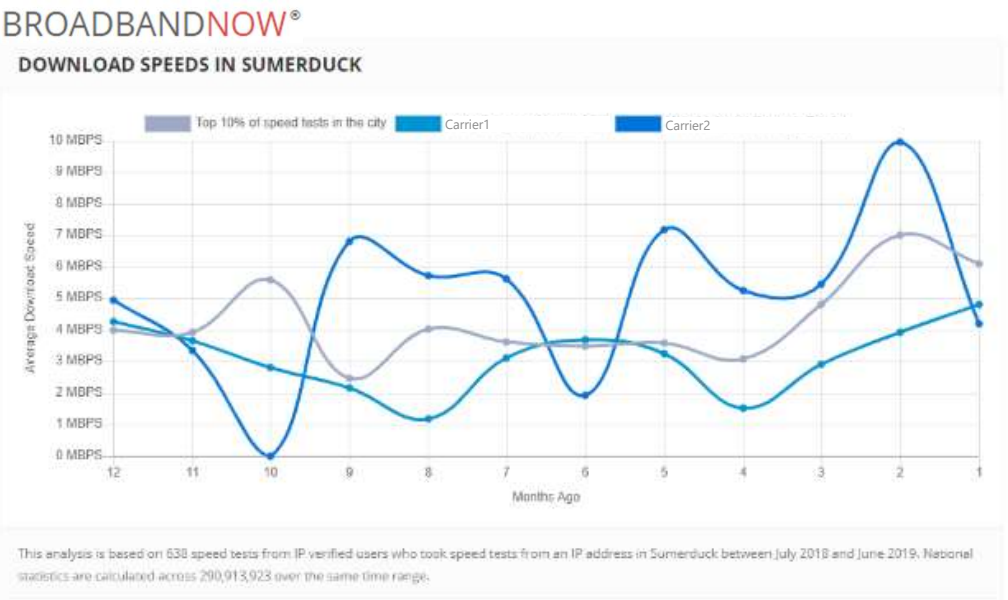


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 22742 in Virginia

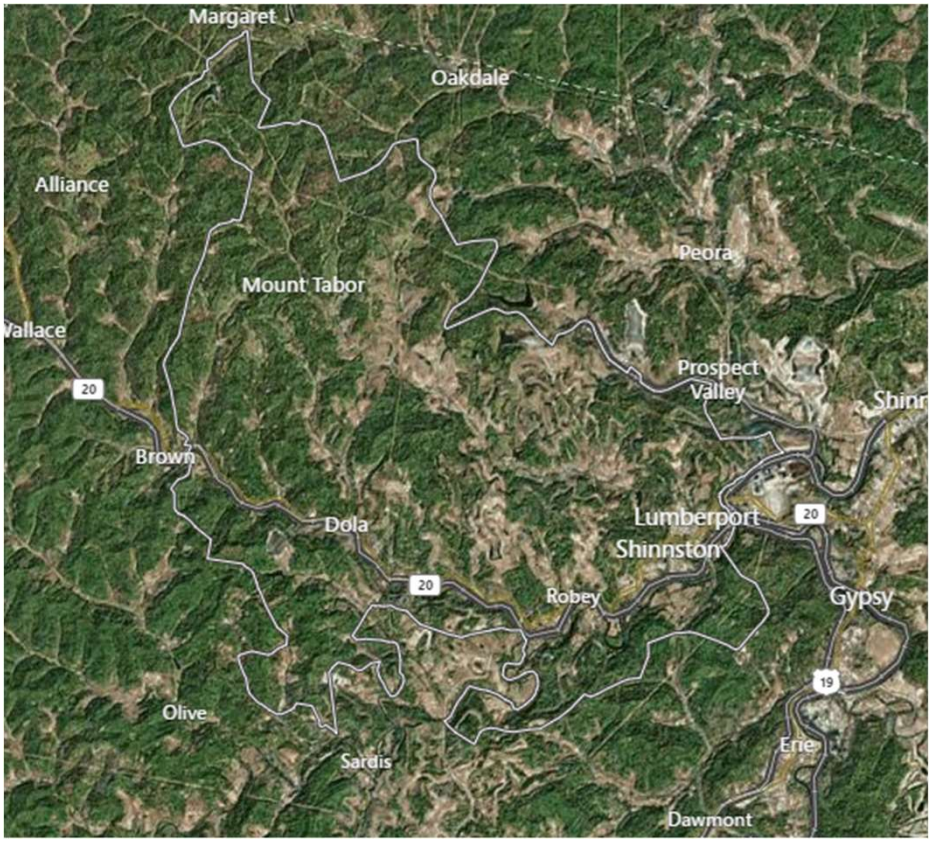
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	0.5%

* *zip codes may contain portions of multiple census tracts*



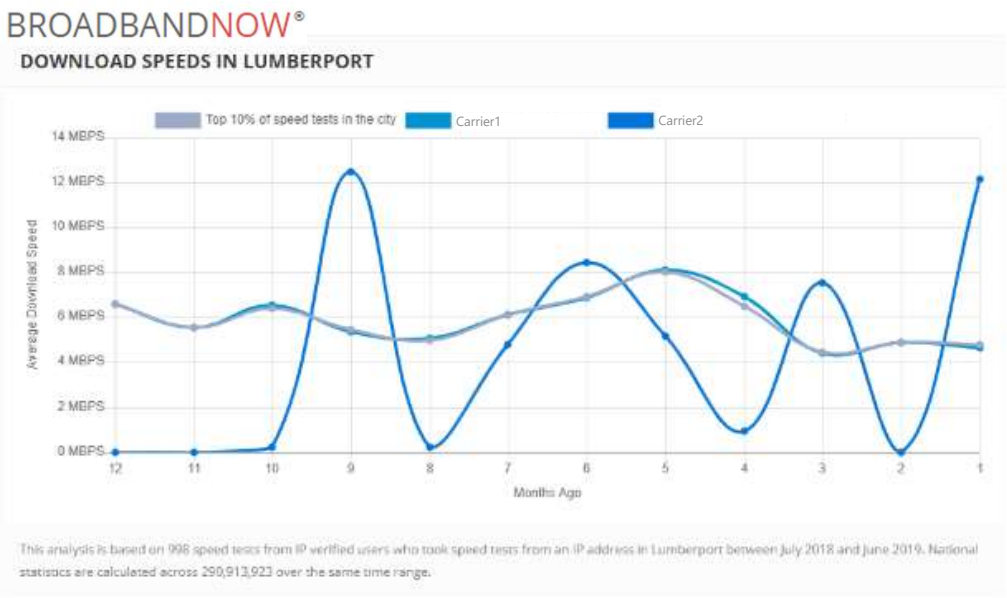
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 26386 in West Virginia



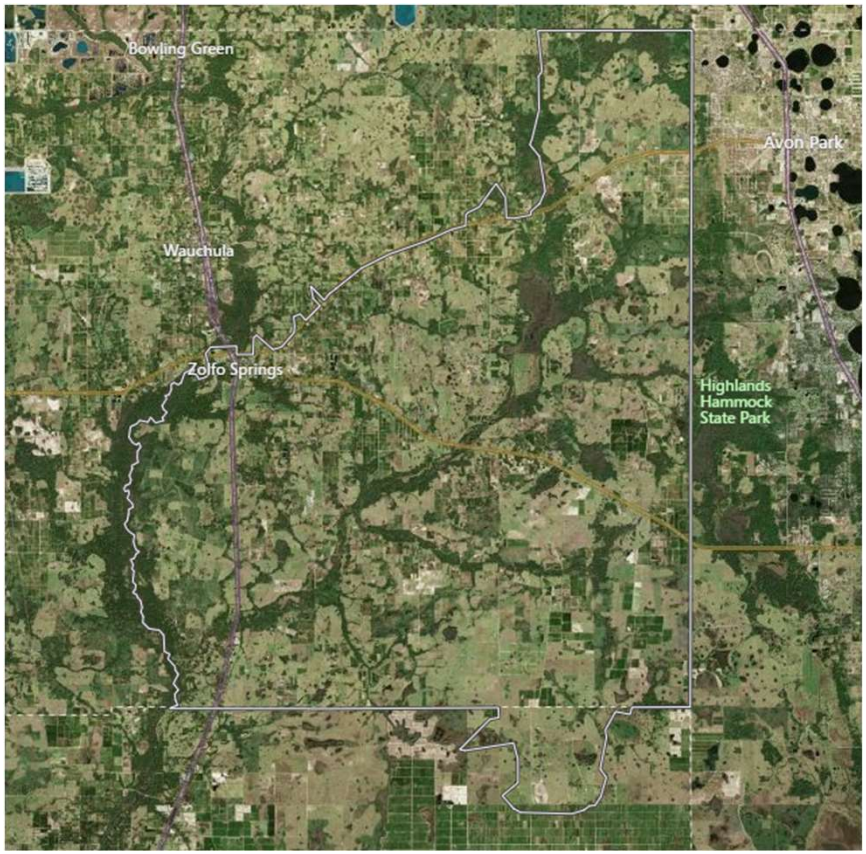
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	9.5%

* *zip codes may contain portions of multiple census tracts*



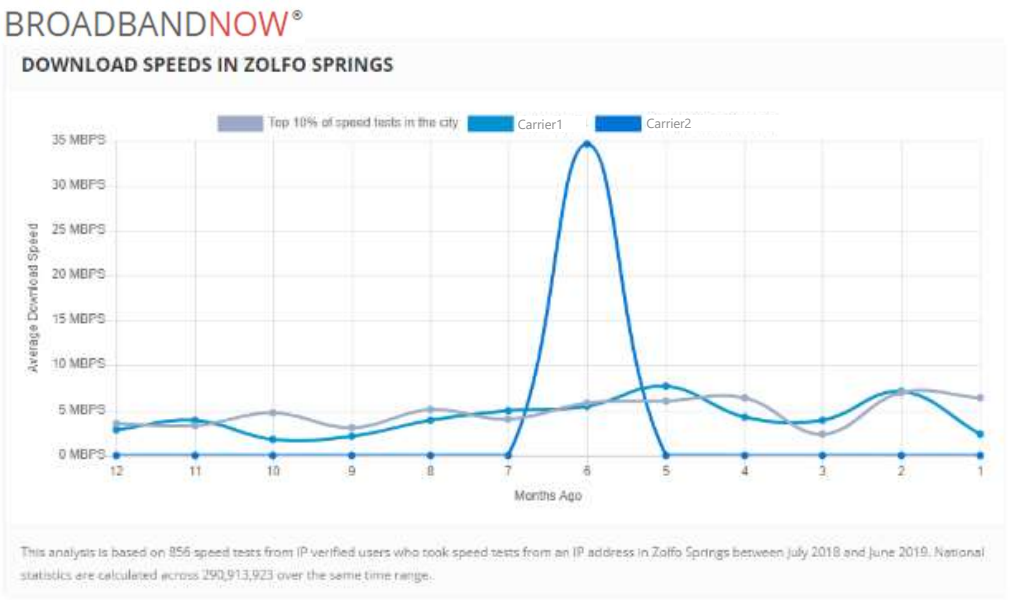
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 33890 in Florida



Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
94.0%	4.7%

* *zip codes may contain portions of multiple census tracts*

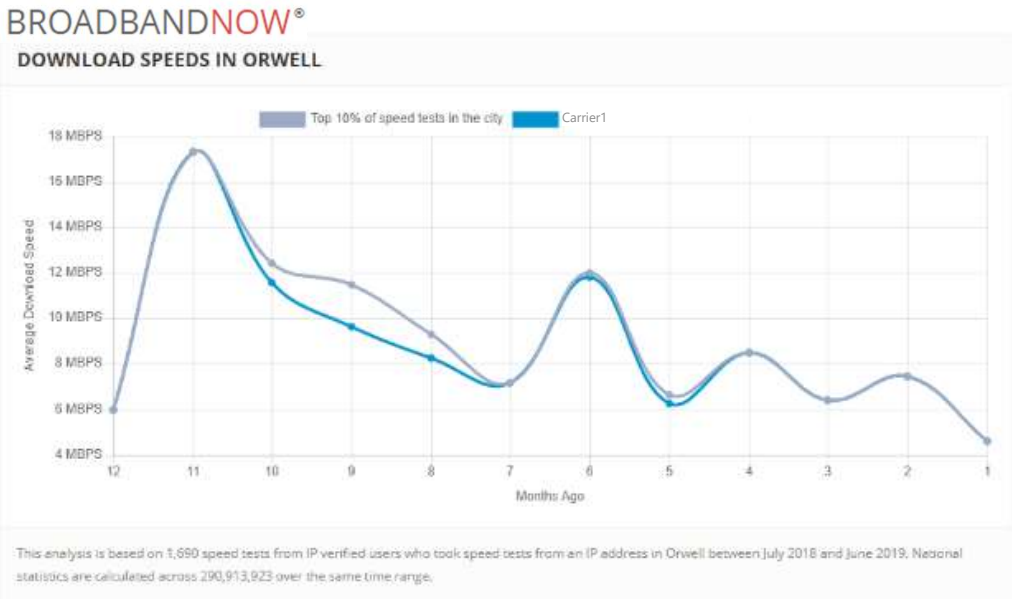


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 44076 in Ohio

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
92.1%	5.9%

* *zip codes may contain portions of multiple census tracts*

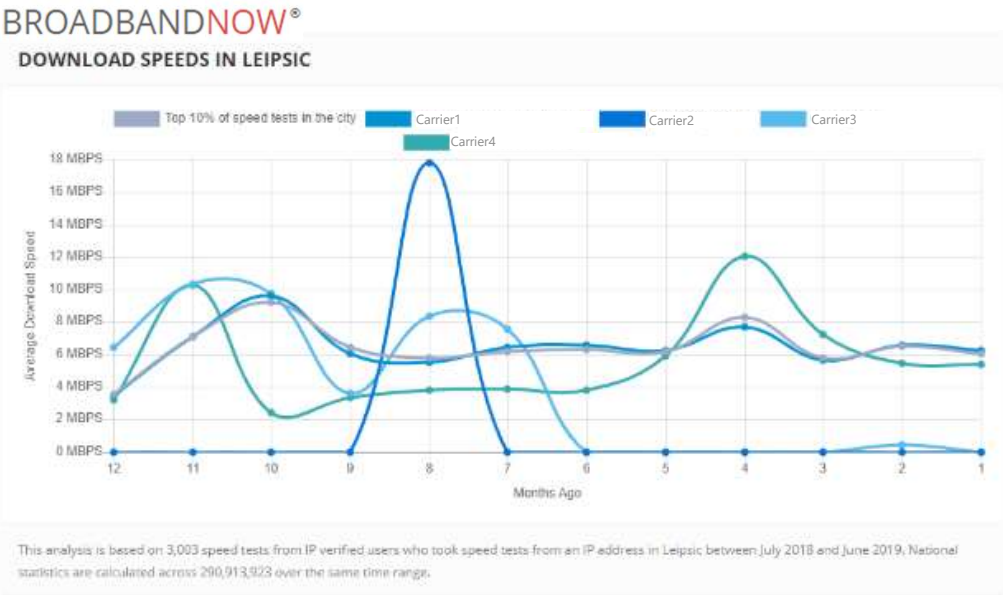


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 45856 in Ohio

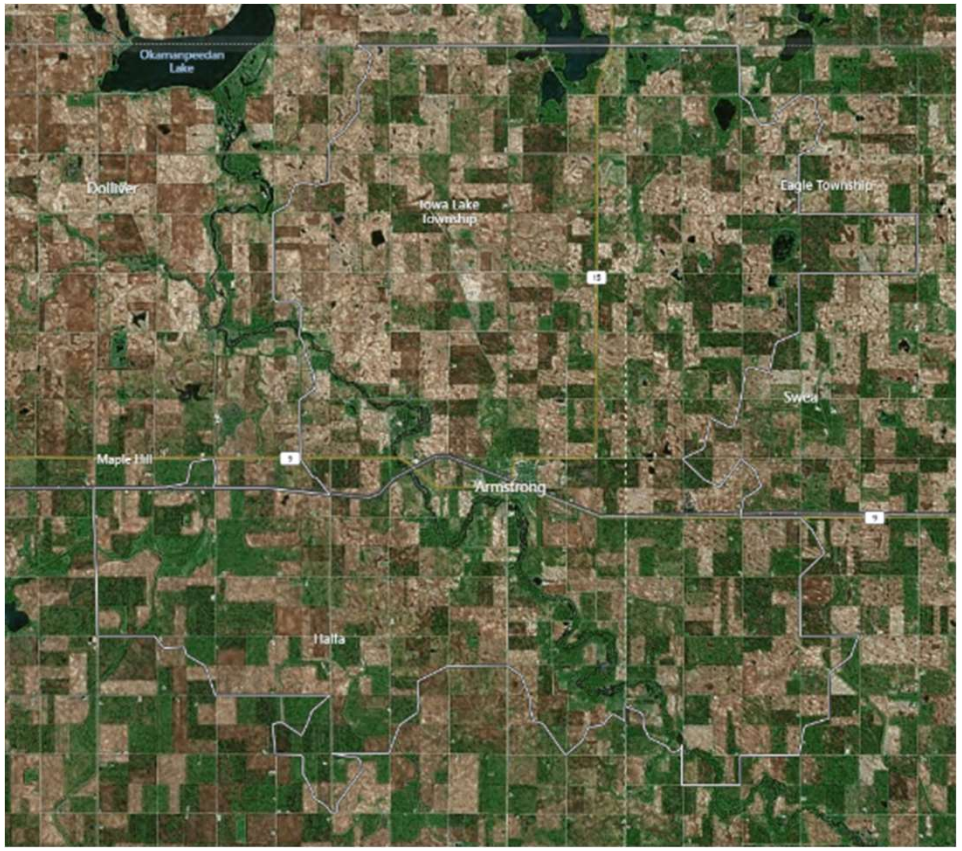
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
98.3%	4.5%

* *zip codes may contain portions of multiple census tracts*



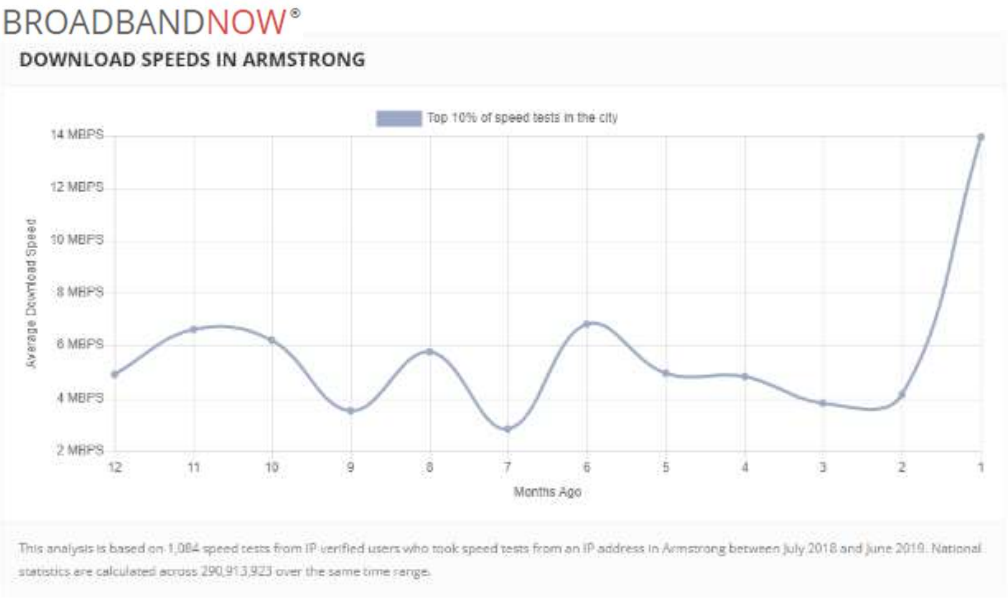
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 50514 in Iowa



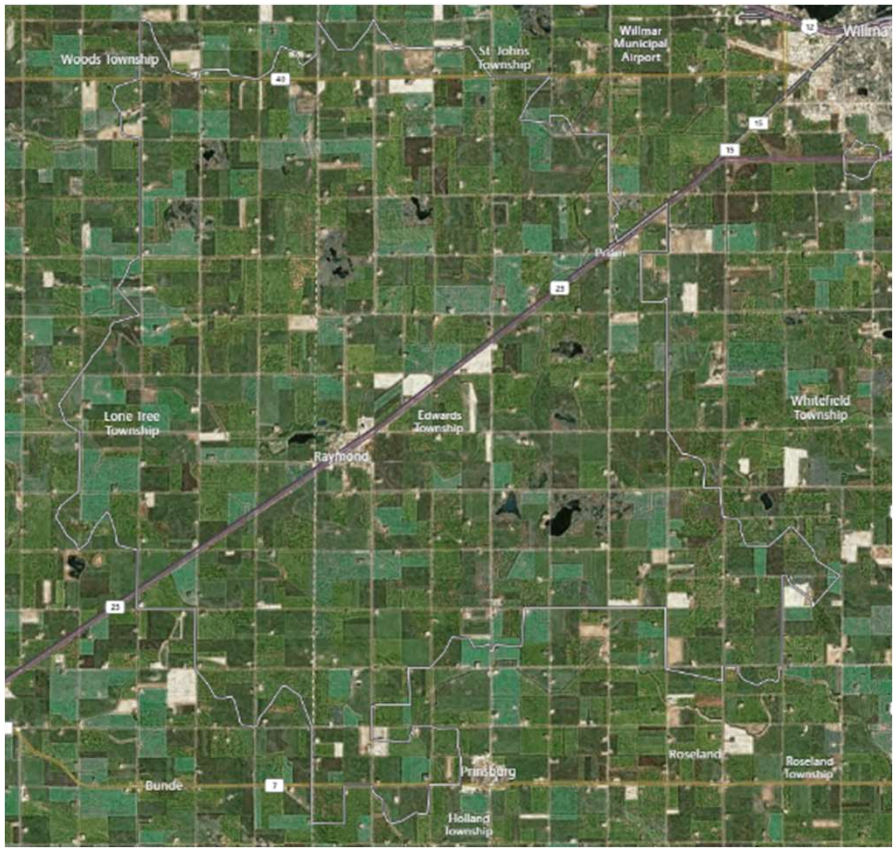
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
98.0%	4.5%

* *zip codes may contain portions of multiple census tracts*



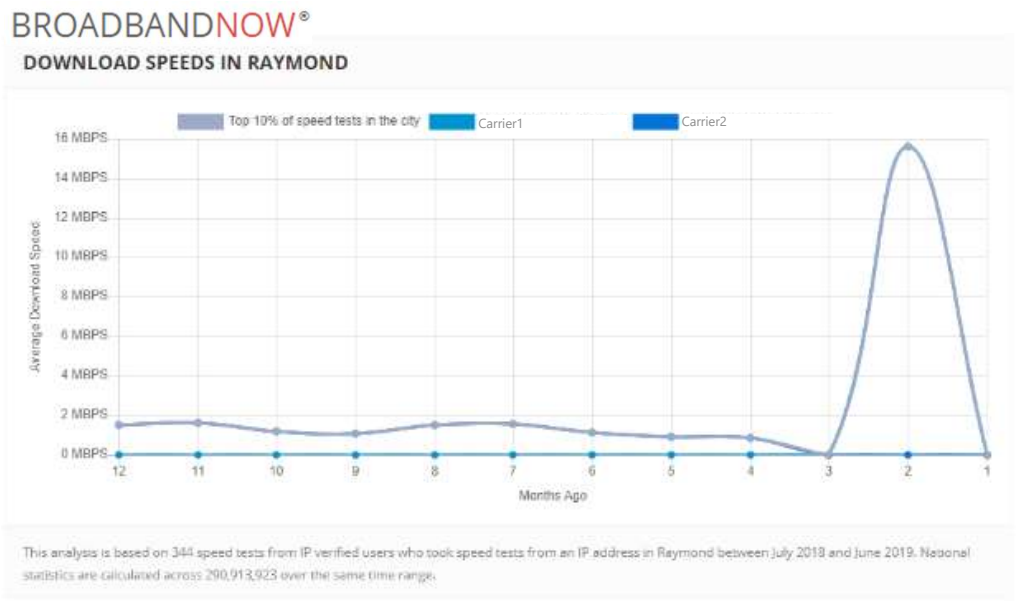
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 56282 in Minnesota



Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	3.7%

* *zip codes may contain portions of multiple census tracts*

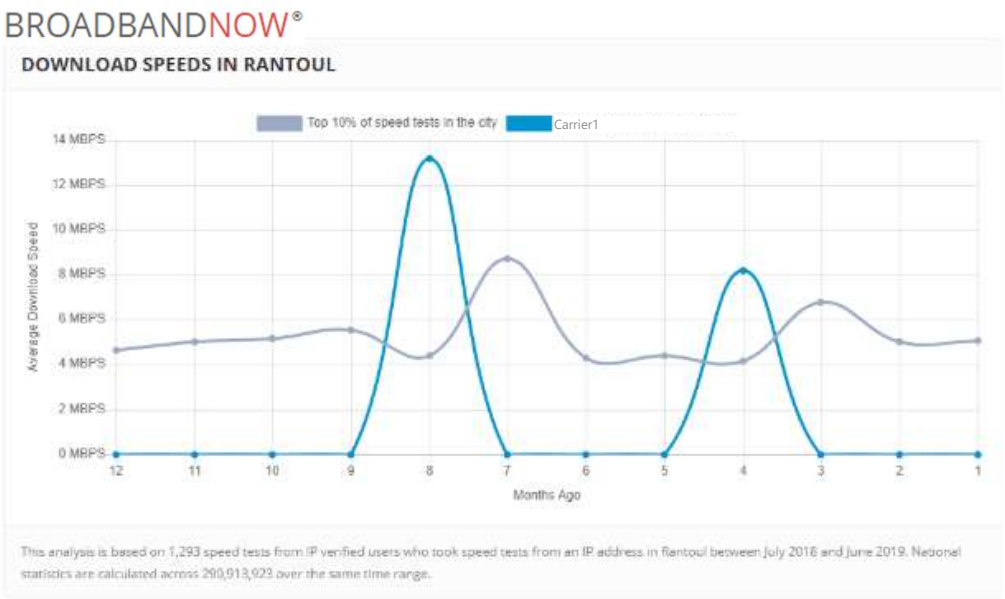


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 66079 in Kansas

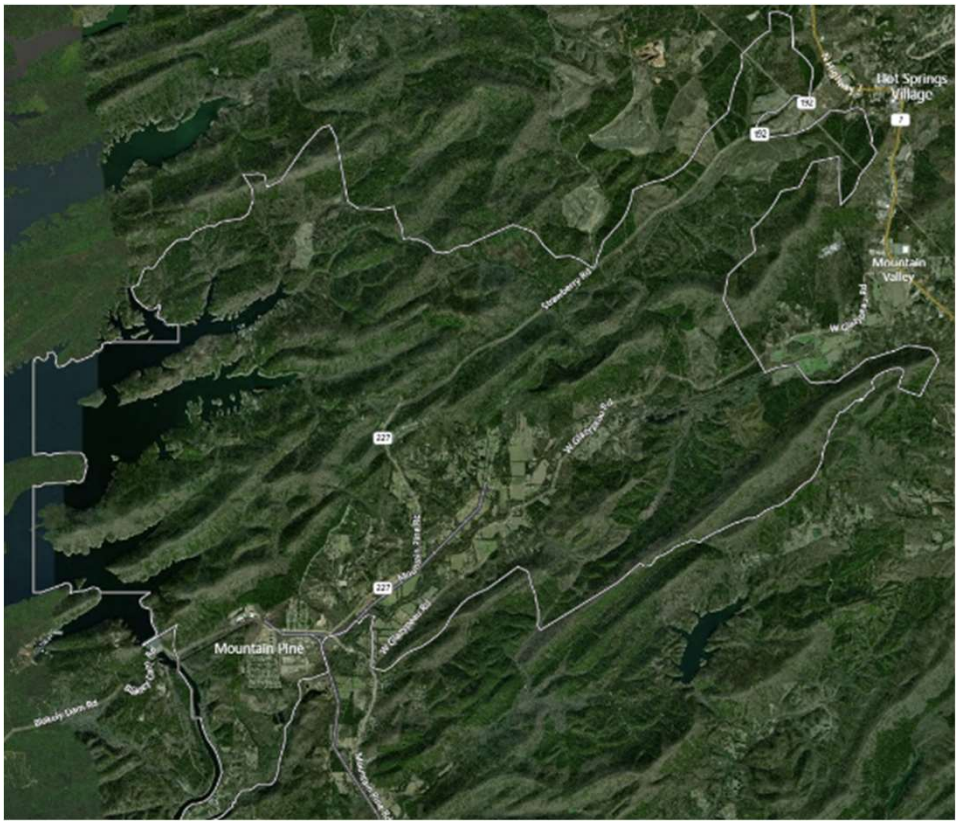
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	0.6%

* *zip codes may contain portions of multiple census tracts*



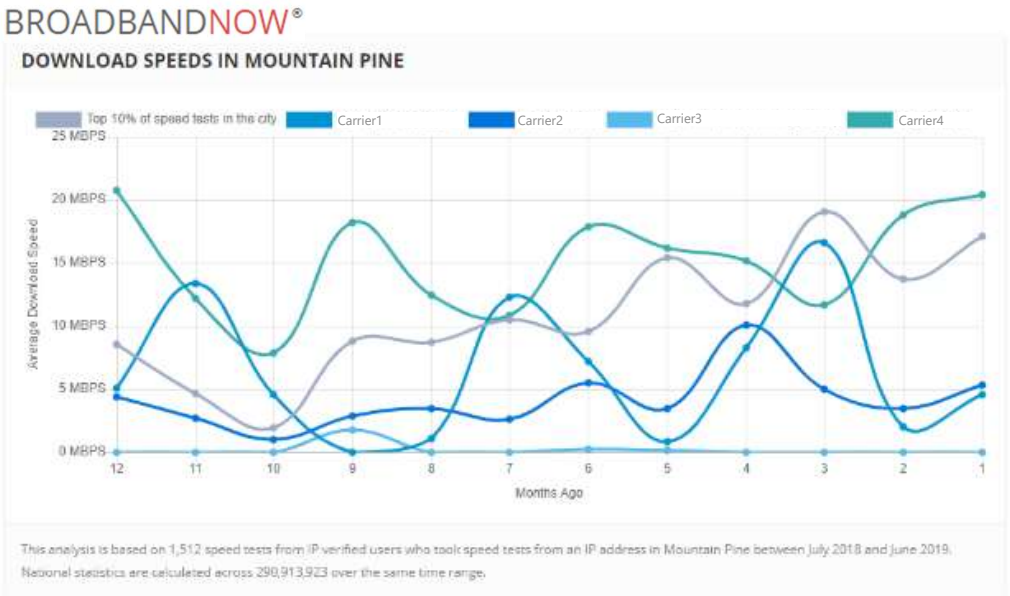
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 71956 in Arkansas



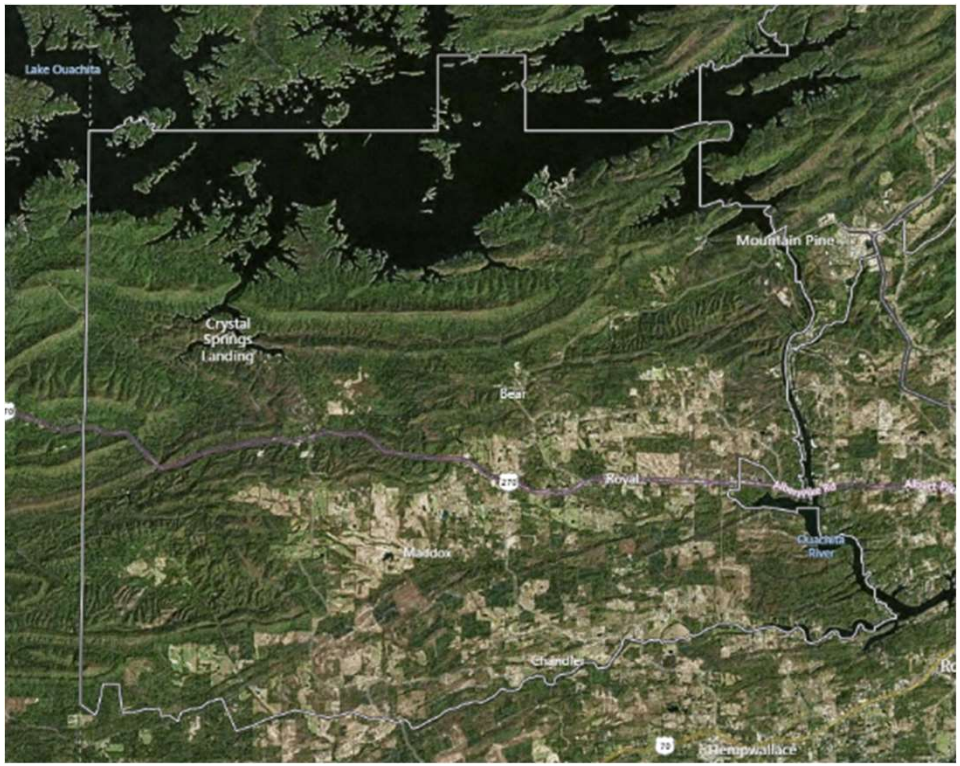
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
97.3%	6.1%

* *zip codes may contain portions of multiple census tracts*



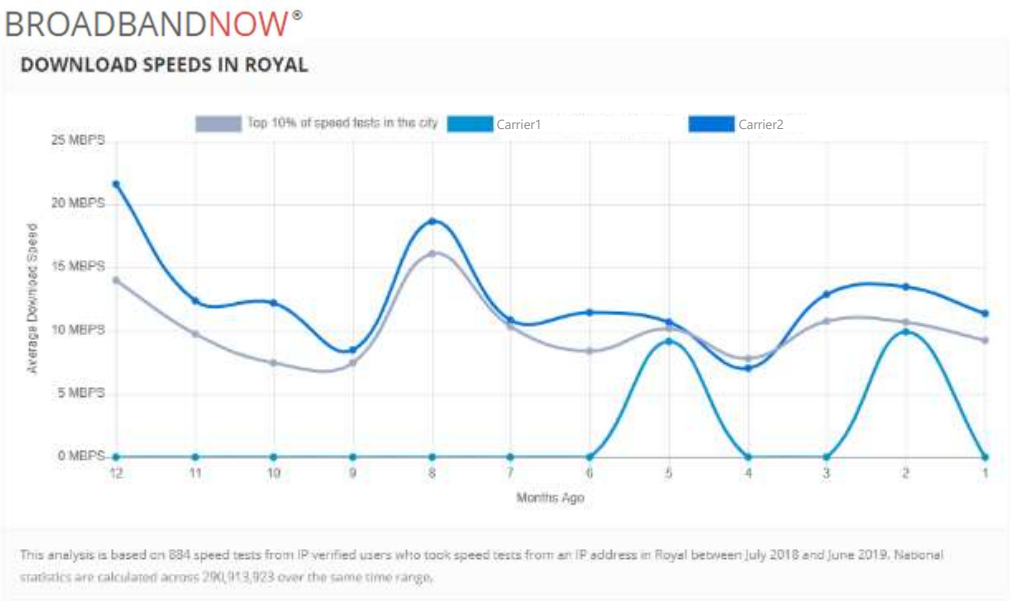
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 71968 in Arkansas



Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
99.1%	7.7%

* *zip codes may contain portions of multiple census tracts*

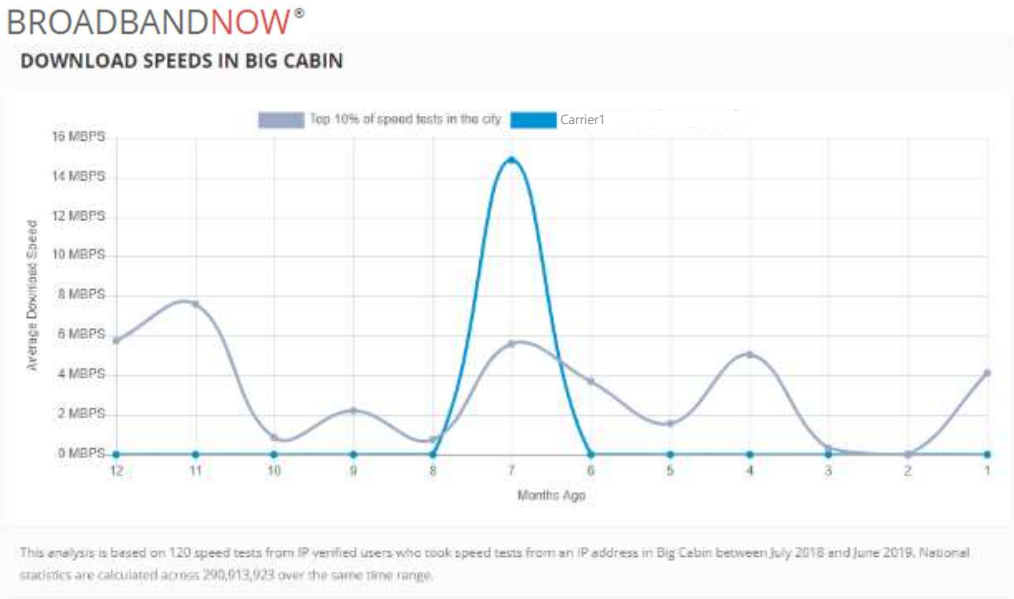


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 74332 in Oklahoma

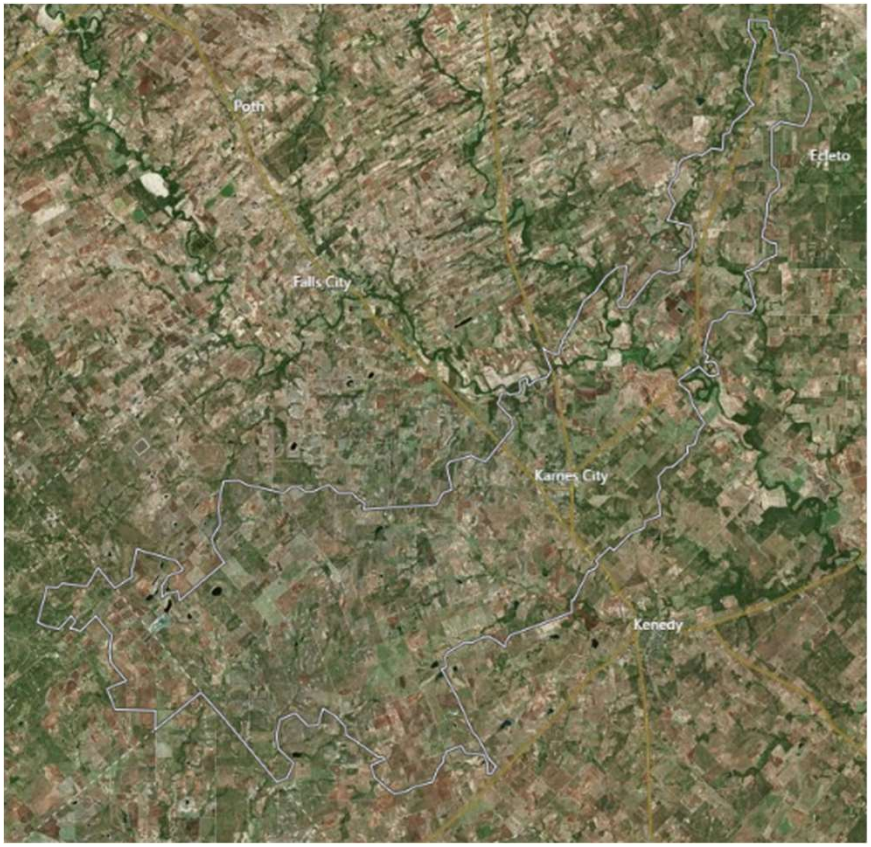
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
99.9%	0.6%

* *zip codes may contain portions of multiple census tracts*



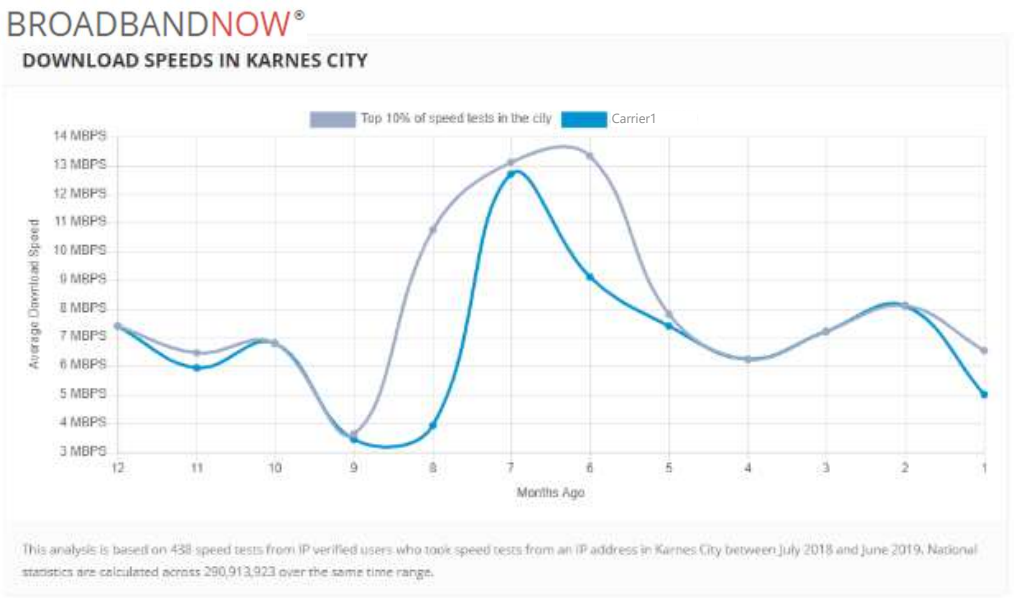
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 78118 in Texas



Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	3.4%

* *zip codes may contain portions of multiple census tracts*

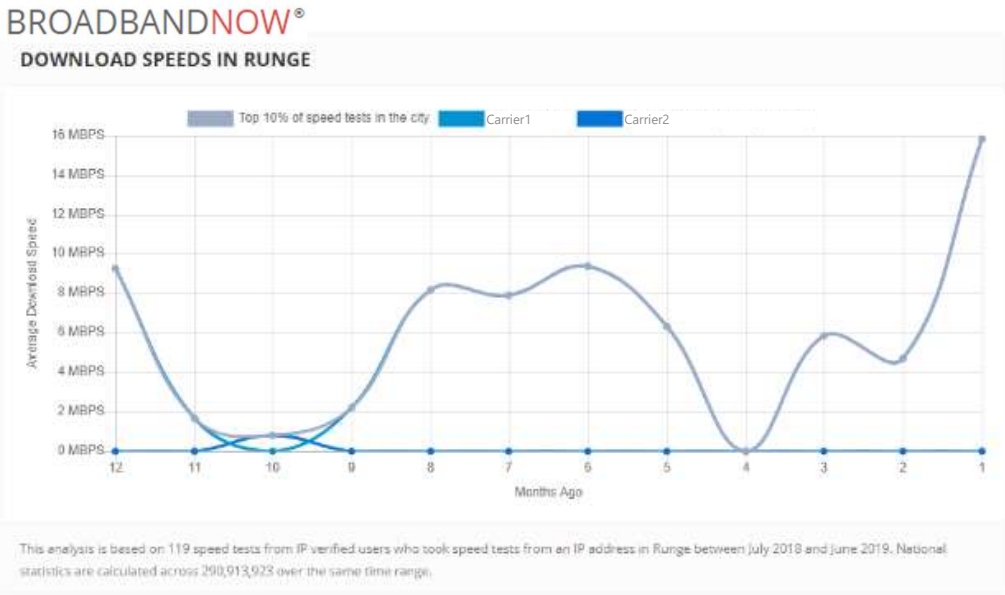


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 78151 in Texas

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
99.6%	0.5%

* *zip codes may contain portions of multiple census tracts*

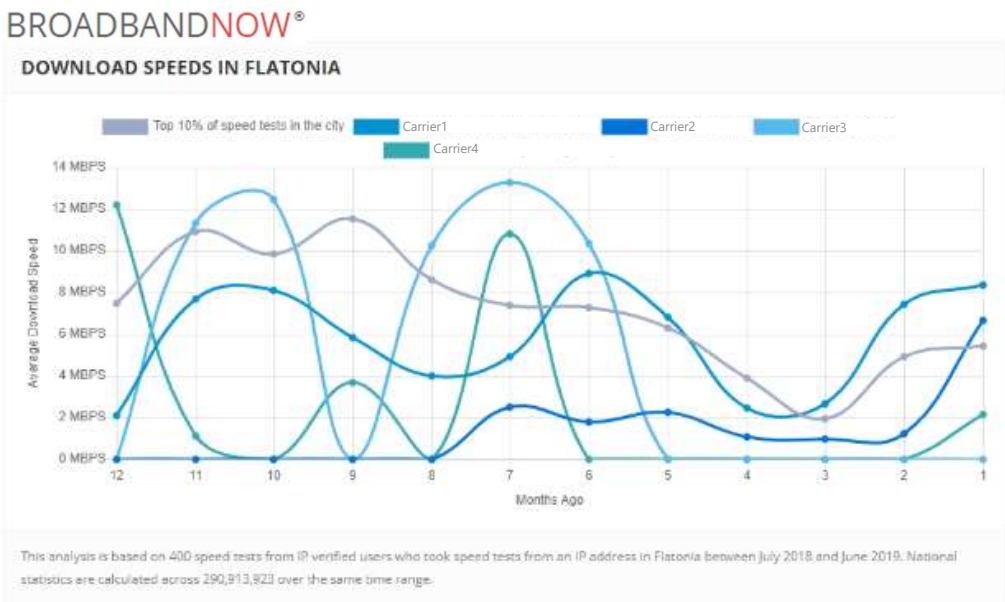


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 78941 in Texas

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
99.5%	2.8%

* *zip codes may contain portions of multiple census tracts*

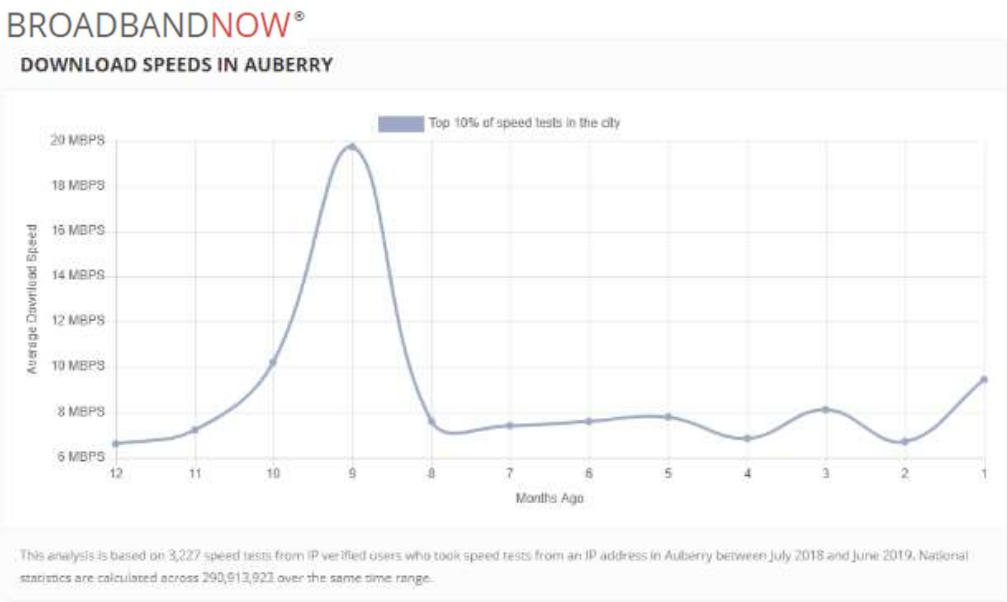


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 93602 in California

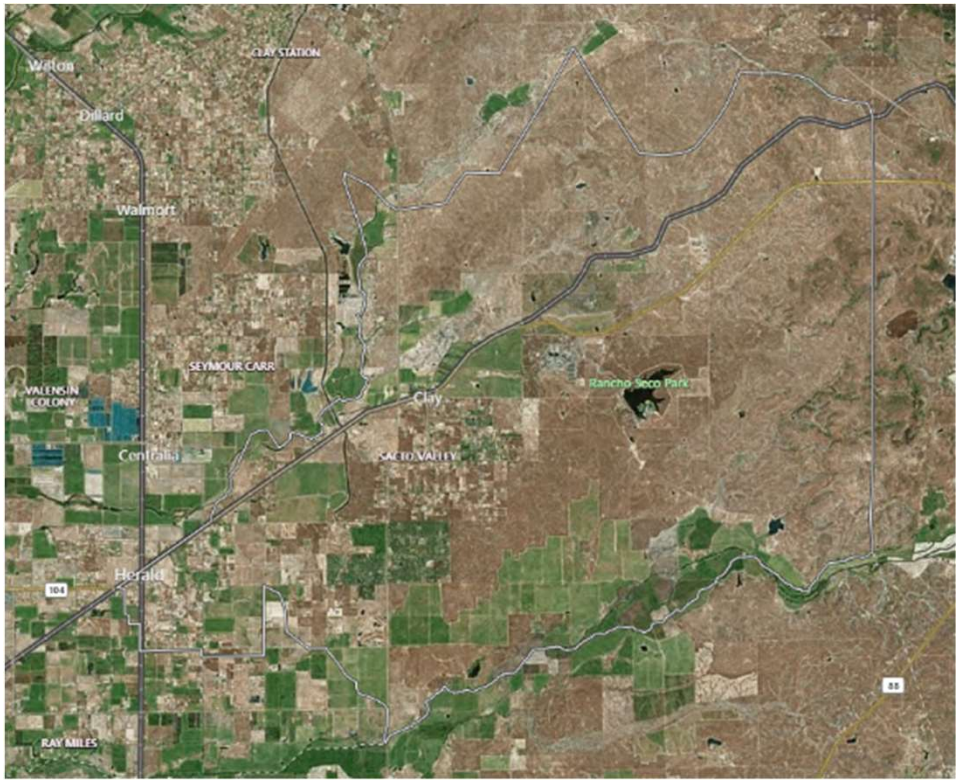
Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
93.7%	8.5%

* *zip codes may contain portions of multiple census tracts*



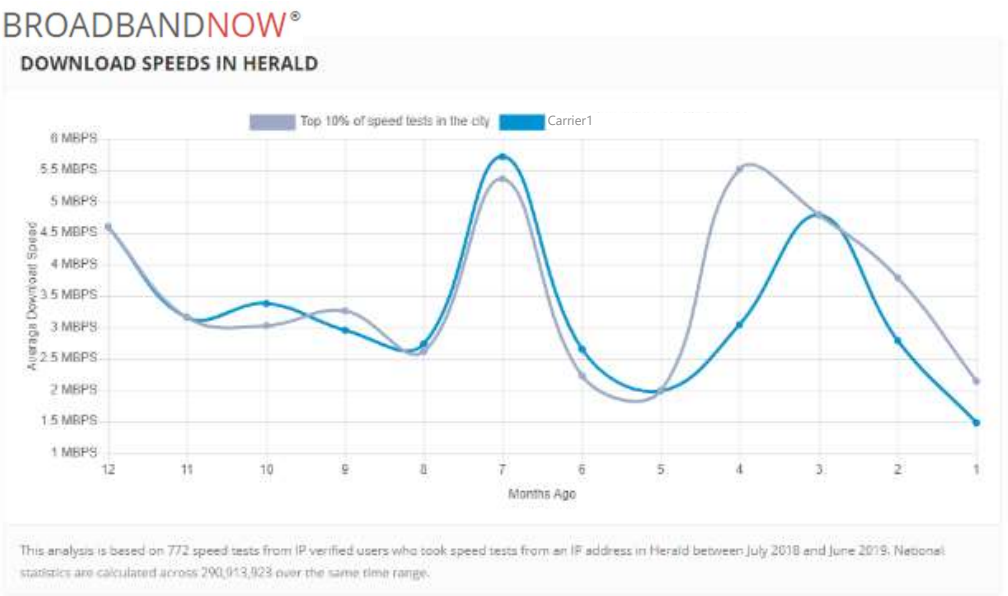
Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 95638 in California



Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	2.2%

* *zip codes may contain portions of multiple census tracts*

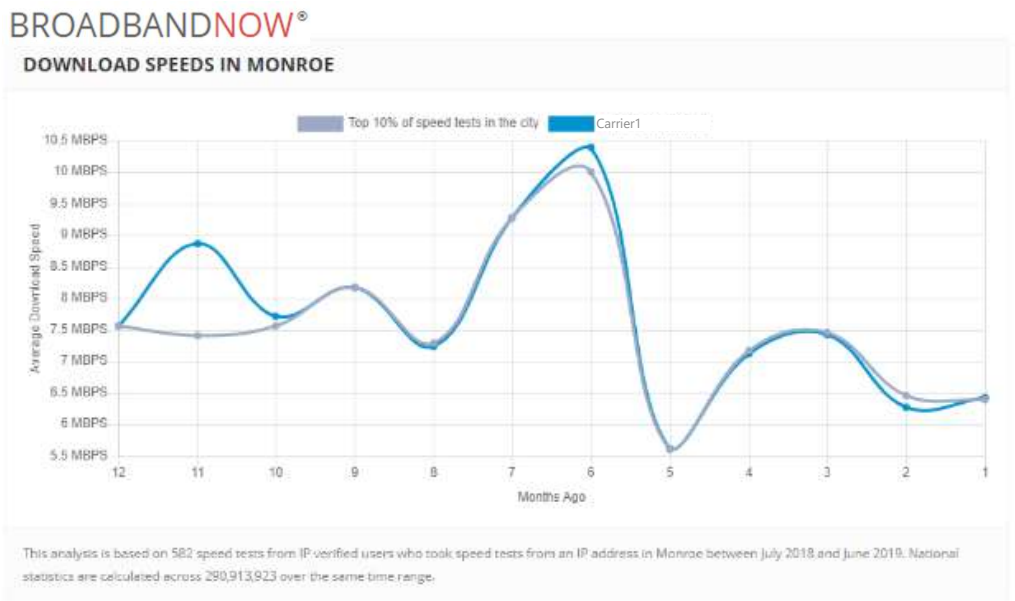


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 97456 in Oregon

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
94.7%	7.6%

* *zip codes may contain portions of multiple census tracts*

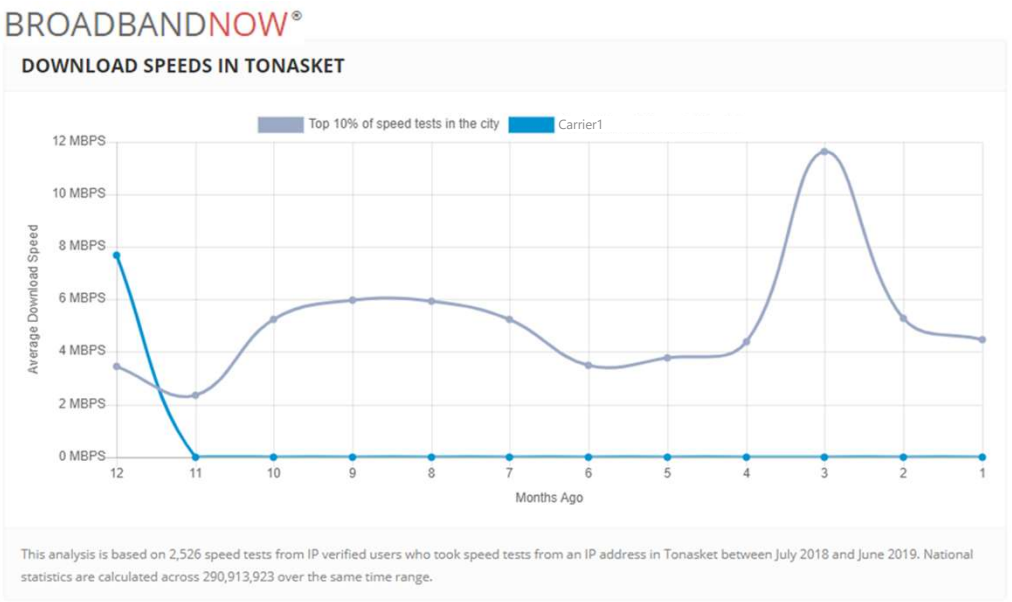


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 98855 in Washington

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
97.9%	7.4%

* *zip codes may contain portions of multiple census tracts*

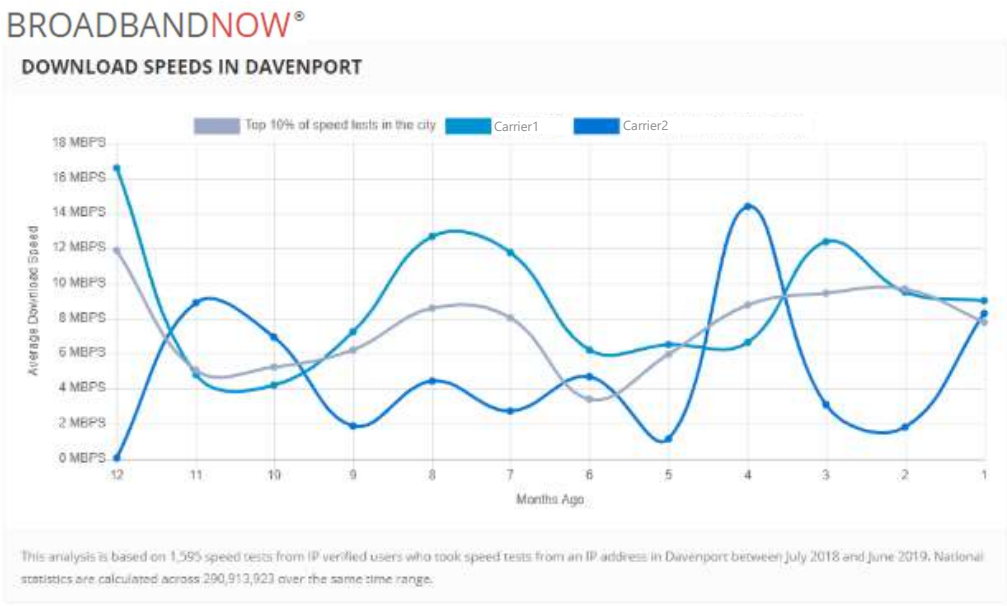


Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

Zip code: 99122 in Washington

Estimated FCC broadband availability* (2019 report)	Estimated percent of people using the internet at broadband speeds using Microsoft data
100.0%	4.0%

* *zip codes may contain portions of multiple census tracts*



Source: FCC 2019 broadband report, Microsoft data, and BroadbandNow.com

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